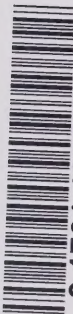


Berger
Exhibit

Pipelines
#125



3 1761 12064642 7

MACKENZIE VALLEY PIPELINE INQUIRY
TESTIMONY - D. E. FIELDER, P. ENG.

Pertaining to Soviet Gas Pipelines
Installed in Permafrost Areas

Canadian Arctic Gas Study Limited
Calgary, Alberta

May 1975

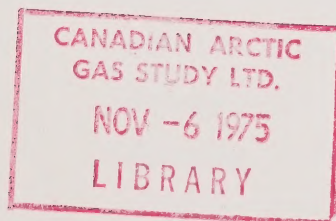
MACKENZIE VALLEY PIPELINE INQUIRY

TESTIMONY - D. E. FIELDER, P. ENG.

May 16 & 20, 1975

Pertaining to Soviet Gas Pipelines

Installed in Permafrost Areas



Canadian Arctic Gas Study Limited

Calgary, Alberta



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MACKENZIE VALLEY PIPELINE INQUIRY

TESTIMONY - D. E. FIELDER, P. ENG.

May 16, 1975

Pages 5191 to 5203 (Inclusive)

Canadian Arctic Gas Study Limited

Calgary, Alberta

Fielder, Hurd, Carlson
In Chief

1 (OPERATIONS & MAINTENANCE PANEL WITNESSES
2 RESUMES MARKED EXHIBIT 122)
3 (LIST OF REPORTS & STUDIES ON WHICH O. & M.
4 PANEL RELIES MARKED EXHIBIT 123)

5 MR. MARSHALL: Q Sir, as
6 you're aware, Mr. Fielder was the representative of
7 Arctic Gas who visited the Soviet Union and you had
8 expressed interest in hearing of his trip. As Mr.
9 Fielder is a member of the panel I thought it might
10 be appropriate to have him deal with that first, and
11 I'd like to proceed with that now before turning to
12 the operations and maintenance testimony itself.

13 Mr. Fielder, have you had
14 any recent exposure to Soviet pipeline design, con-
15 struction and operating techniques with special
16 emphasis on Arctic and permafrost problems?

17 WITNESS FIELDER: Yes sir.
18 During the period from November 19 through December 2,
19 1974, I, accompanied by several other Canadians with
20 varied interests, but generally pertaining to the gas
21 industry, visited the Soviet Union. The visit was
22 organized and sponsored by the Federal Department of
23 Industry, Trade & Commerce, and formed part of the
24 Canadian contribution to an organized exchange of
25 technology relating to the gas industry.

26 You might also be interested
27 to learn that during a subsequent and reciprocal visit
28 I acted as host to a group of Soviet experts in
29 Calgary on Friday, March 21 of 1975. During that
30 meeting a member of Dr. Clark's staff described to the

Fielder, Hurd, Carlson
In Chief

1 Soviets the status of our research in the field of
2 frost heave, and we all answered many questions they
3 posed mostly related to foundation design in ice-
4 rich permafrost .

5 During my visit to Russia,
6 meetings were held with various senior members of the
7 U.S.S.R. Gas Ministry and other associated Ministries
8 in Moscow, in Donetsk in the Ukraine -- that's
9 spelled D-O-N-E-T-S-K -- in Tuymen and Nadym in
10 Western and Northwestern Siberia. Tuymen is spelled,
11 T-U-Y-M-E-N and Nadym, N-A-D-Y-M.

12 The purpose of the questions
13 posed by we Canadians was to determine the manner in
14 which the Soviets deal with problems relating to the
15 development of gas fields, i.e. the drilling, the
16 construction and operation of gas gathering systems,
17 and treatment plants, and the design, construction and
18 operation of gas pipelines and compressor stations,
19 all in areas of permafrost.

20 Q Why were you selected
21 to participate in this visit?

22 A At the time the selection
23 of Canadian delegates was made, I was manager of the
24 Pipeline Design Section of Arctic Gas. I was both
25 interested and had an obvious need to learn as much
26 as was possible respecting Soviet permafrost engineer-
27 ing as it applies to the design, construction and
28 operation of gas pipelines.

29 Q Would you tell us briefly
30 what you learned, Mr. Fielder?

Fielder, Hurd, Carlson
In Chief

1 A Unfortunately, not a
2 great deal. We were all very disappointed to learn
3 after our arrival in Moscow that while the area we
4 were to visit in the Soviet Arctic is described as an
5 area of discontinuous permafrost, that most of the
6 pipeline and all of the above ground facilities had
7 been located deliberately in areas which contained
8 little or no permafrost. The area I refer to is the
9 southern portion of the Medverzhye gas field, and
10 that's spelled M-E-D-V-E-R-Z-H-Y-E, that's the
11 Medverzhye gas field which is located in Northwestern
12 Siberia approximately 1,200 km. or 746 miles north
13 of the City of Tuymen, which is located in the
14 Province of Tuymen. It's also approximately 50
15 km. or 31 miles from the Arctic Ocean. The pipelines
16 serving that area run generally south-west from the
17 Medverzhye area to serve markets in the Urals and
18 in Moscow, and they utilize both buried and grade
19 or bermed construction techniques.

20 Q How was it possible for
21 the Soviets to avoid permafrost terrain problems when
22 locating their pipelines and above-ground facilities
23 in an area of discontinuous permafrost?

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1 A Avoidance of
2 permafrost areas along the pipeline route was
3 accomplished by locating all of the facilities as
4 much as was possible in river floodplains which
5 do not contain permafrost. Between the river
6 valleys the pipelines were located along relatively
7 high ridges of well-drained permafrost. The
8 area is predominantly sand which was, we are
9 told, easily trenched and caused very few problems.

10 The area that we saw was
11 very old. Never, we were told, having been
12 glaciated. The river valleys were very wide up
13 to about 13 kilometers or about 8 miles with the
14 wetted banks being only three to four meters
15 or ten to thirteen feet in height. Secondary
16 banks had very gentle slopes and the relief in
17 the area appeared from the air to be less than
18 30 meters or about 98 feet.

19 As I mentioned earlier the
20 soil was mostly sand and was well drained in the
21 higher areas. Now, problems with the permafrost
22 there were so minimal that the gas pipelines are
23 operated at a temperature range of plus 3 to plus
24 40 Celsius which is 37 to 104 degrees fahrenheit.
25 --As you can see, well above the melting temperature
26 of ice.

27 Q Did you discover any-
28 thing relevant during your visits to design or
29 research center in the Soviet Union?

30 A I visited both

1 design and research institutes in Moscow, Donetsk and
2 in the City of Tuymen. It is very difficult
3 to evaluate the usefulness of what we were told during
4 our several visits. Firstly, with respect to design, we
5 were shown, just for example, the manner in which burried
6 and grade construction techniques are designed for perma-
7 frost areas, but were not able to see those designs either
8 being constructed or to be able to evaluate any operational
9 problems which might have occurred as a result; we
10 were told, however, that berms often had to be
11 re-built annually and indeed we saw some of that
12 work going on .

13 As far as research is concerned,
14 we were told that a great deal of basic permafrost
15 research is, and has been carried out but saw little
16 evidence of the implementation of that research. I do
17 not mean to imply that Soviet research programs are never
18 translated into designs and construction techniques, be-
19 cause if this were the case they would not have been
20 able to carry out the very extensive development that
21 they have of their northern resources. Obviously, a great
22 deal of useful work has been done. Some of the members
23 of Dr. Clark's panel, as was previously mentioned,
24 attended the 2nd International Conference on Permafrost
25 which was held in Yakutsk in June of 1973, and speak very
26 highly of the amount and type of research which was carried
27 out in the Soviet Union.

28 Q Are there other areas
29 in the Soviet Union in which pipelines have been
30 installed in Arctic areas containing permafrost which

1 could be more useful from an educational
2 point of view?

3 A There are two other
4 pipelines which are located in the permafrost in the
5 Soviet Union. One runs between Norilsk and
6 Messoyakha and Norilsk is spelled N.O.R.I.L.S.K.
7 and Messoyakha is spelled M.E.S.S.O.Y.A.K.H.A.
8 It runs between Norilsk and Messoyakha and is constructed
9 above ground on piles. The other is in the Yakutsk
10 area and is partly on piles and partly buried. Two earlier
11 Canadian delegations visited the Norilsk-Messoyakha line
12 and perusal of their reports did not add a great deal to
13 our / knowledge of permafrost pipeline techniques. The
14 primary purpose of one of the groups was to note the en-
15 vironmental after effects and according to the
16 report they noted very little lasting environmental
17 damage.

18 ANother clue that strengthens
19 my impression that we will not likely learn a
20 great deal more from additional visits to Russia,
21 is that I discovered in my visits that the Soviets
22 had not constructed any test sites prior to
23 starting designs and construction and apparently
24 now feel that test sites are required.
25 I was questioned at length about what we had learned
26 from our Arctic gas sites, how they were laid out,
27 pipe sizes, fluid temperatures tested and measuring
28 equipment utilized and that sort of thing. I was
29 also asked to approve the training of a Soviet
30 engineer or research scientist for a period of

Fielder , Hurd, Carlson
In Chief

1 45 days at the Sans Sault Test Site. During the
2 course of these discussions I learned that the
3 Soviets now plan to construct two pipeline and
4 several gas well test sites in the
5 Medverzhye area of Siberia.

6 During my meeting with the
7 Soviet delegation in Calgary on March 21, I
8 was able to confirm that the three systems that I described
9 earlier are the only ones installed installed in
10 the Soviet Union in permafrost and that no pipelines
11 have been buried there in ice rich permafrost. IN
12 anticipation of having to do so they asked us
13 many questions relating to our plans for foundation
14 designs for heavy rotating machinery in areas
15 containing ice-rich permafrost.

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Incidentally, you should know that access to the areas I've described in the Soviet Union is very difficult and is normally considered out of bounds to westerners. Access is only available as a result of the Canada-U.S.S.R. Industrial Exchange Agreement on Science and Technology, which was organized by the Federal Department of Industry, Trade & Commerce. Part of that agreement provides for the sort of trips I have just described.

11 Q In what manner do you
12 think Arctic Gas and other interested Canadian groups
13 can best keep abreast of and make use of the permafrost
14 research carried out by the Soviets?

15 A By keeping abreast of
16 developments as described in the literature. The
17 National Research Council of Canada publishes trans-
18 lations of such papers, and these are available at
19 little cost.

20 MR. MARSHALL:
Thank you, Mr. Fielder.

21 Mr. Scott suggested that perhaps we just proceed
22 with the O. & M. panel, sir, without having Mr.
23 Fiedler cross-examined separately at this time, if
24 that meets with your approval I think we will just
25 carry on.

26 MR. SCOTT: I raised at an
27 earlier stage with Mr. Genest, I'm not sure whether
28 it was formally at the hearing or informally, the
29 question of providing to us a copy of Mr. Fielder's
30 report to the Department of Industry, Trade & Commerce

Fielder, Hurd, Carlson
In Chief

1 and the question of producing for us, with the co-
2 operation of the government, the joint report of all
3 participants on this trip which was compiled by
4 the Department. I wonder if Mr. Marshall is able to
5 tell us whether either of those things are possible,
6 and what they have done about it. I understand he
7 hasn't gotten them yet.

8 MR. MARSHALL: I believe the
9 reports have been listed in the index and have been
10 available in the library upstairs for some weeks.
11 But I shall check that, Mr. Scott.

12 MR. SCOTT: Thank you.

13 THE COMMISSIONER: Well, before
14 you proceed with the other members of the panel, let
15 me just ask Mr. Fielder a few questions.

16 Q These three pipeline
17 systems, Mr. Fielder, how long are they? What is the
18 length of each pipeline system, do you know?

19 A Not in detail, sir.
20 I don't have any information on the pipeline in the
21 Yakutsk area at all. As far as I know, no reports
22 are available, I haven't seen any. The Messoyakha-
23 Norilsk pipeline, I think I can answer that very
24 quickly here -- sir, I don't have the length of that.
25 It's buried in this report somewhere, I can dig it
26 out for you. One thing I could mention to you is that
27 when they built it on piles, being concerned about
28 the effects of temperature on the pipeline that was
29 exposed and also in an attempt to avoid permafrost
30 as much as possible, the line snaked around enough

Fielder, Hurd, Carlson
In Chief

1 that it increased its length by approximately 13%
2 over the straight line distance that could have been
3 taken, had they decided to do so.

4 Q Do you know what the
5 diameter of the pipeline was?

6 A The Messoyakha-Norilsk
7 Pipelines, two of them now, and they're both 72 centi-
8 meters or 28-inch, the lines that run from the
9 Medverzhye field down through a place called Punga
10 and eventually on into the Soviet grid system was
11 48-inch, the initial diameter was 48-inch. It's
12 since been partially looped at least once, and
13 partially looped twice in places with 56-inch. I
14 don't know the length of those lines either, sir,
15 because the map we were given is written in Russian
16 and as they use a different alphabet than us, it
17 makes it very difficult to sort the thing out. But
18 it's hundreds of miles.

19 Q Thank you. In the
20 Soviet Union, as I understand it, the industrialized
21 part of the country is in the west, in the sense that
22 the industrialized part of our country is in the
23 south, putting it very roughly.

24 A I think that's correct.

25 Q Are they transporting
26 that gas merely to local centres in the vicinity of
27 the Arctic Circle, comparable say to Yellowknife or
28 Whitehorse, or even to Inuvik or smaller places than
29 Yellowknife and Whitehorse, or did you say that they're
30 tying it into some -- into their whole natural gas

Fielder, Hurd, Carlson
In Chief

1 grid so that the gas winds up in the industrialized
2 sector of the Soviet Union?

3 A The latter, sir. The
4 connection to the Soviet grid system has certainly
5 been made. I am not certain that gas from the North-
6 western Arctic or Northwestern Siberia actually ends
7 up at some of the industrial locations because in
8 addition to their own uses they are exporting a great
9 amount of natural gas to other countries in Europe,
10 and it may well be that it goes there. But certainly
11 it's tied in with the system.

12 Q You said that you were
13 advised when you were there that -- you indicated that
14 the conditions in which you found these pipelines were
15 such that there wasn't a great deal that you could
16 learn from the Soviet experience. You said they wanted
17 to set up test facilities because they were going to
18 undertake building pipelines in conditions similar to
19 those of the Arctic Gas proposal here. Is that
20 essentially what you meant?

21 A Yes sir. They were
22 anticipating, as they expanded the Medverzhye field
23 into the northern end of the field they would run into
24 ice-rich permafrost and hence were concerned about
25 what might happen when they install the warm gas
26 pipelines that they seem to prefer, for reasons I
27 don't understand.

28 Q We were told that one
29 of the likely results of detente would be -- I
30 shouldn't say "one of the likely results" but I think

Fielder, Hurd, Carlson
In Chief

1 you will recollect that it was suggested that one
2 of the possible results of detente might be to
3 export natural gas from Siberia to the mainland, the
4 lower 48 in North America. Was there -- were these
5 new lines that were being discussed connected in
6 any way with that proposal, or was that simply a
7 proposal that no one indicated to you was being
8 pursued?

9 A I know from a separate
10 source that the proposal you mentioned is still being
11 considered. But I understand that the gas location
12 is somewhere in what I'd call Southeastern Siberia
13 off to the East Coast somewhere north of Japan, and
14 these are in areas of non-permafrost. As I understand
15 it would be a liquification sort of a scheme. It
16 had nothing to do with our trip, and many, many
17 thousands of miles away.

18 Q And it wouldn't be
19 brought -- it would be brought by -- liquified and
20 brought by tanker then, presumably, if it were done.

21 A That's what I understand
22 sir, yes.

23 Q Well, thank you very
24 much, Mr. Fielder. I wonder if you, since I think
25 you will
26 be obliged to return on Tuesday, if you wouldn't mind
27 over the weekend, just as a favor to the rest of us,
28 to draw a rough map -- I mean by hand, don't go
29 to any trouble -- of the location of these gas lines
30 in the Soviet Union so that we might have some idea
of where the Medverzhye field is and so on and so

Fielder, Hurd, Carlson
In Chief

1 forth if you don't mind?

2 A I'd be pleased to do so.

3 THE COMMISSIONER: Well, carry
4 on, Mr. Marshall.

5 MR. MARSHALL: Thank you, sir.

6 Q Mr. Hurd, I understand
7 that the substance of the testimony of your panel is
8 contained in Section 13 B filed with the Inquiry as
9 Exhibit 55, and in certain responses to the Pipeline
10 Application Assessment Group questions which were
11 also filed, specifically the question numbers were
12 22, 54 and 55. Sir, would you highlight for us, please,
13 the O. & M. plans described in those documents?

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MACKENZIE VALLEY PIPELINE INQUIRY

TESTIMONY - D.E. FIELDER, P.ENG.

May 20, 1975

Pages 5273 to 5283 (inclusive)

CANADIAN ARCTIC GAS STUDY LIMITED

Calgary, Alberta

Yellowknife, N.W.T.

May 20, 1975.

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

~~MR. SCOTT, Mr. Commissioner,~~

I thought it might be useful to all participants at this stage to tender as an exhibit a document entitled: "Mackenzie Delta, a Summary Report of Surface Conditions".

It is a report prepared by Helen Kerfoot of the Terrain Sciences Division, Geological Survey of Canada, the Department of Energy, Mines & Resources, and is a discussion of the physical environment of the on-shore portion of the modern Mackenzie Delta, and it will be useful in view of the proposed alternate route across the delta. It is in part supplemented by recent field observations by the author, but the report is basically a synthesis of available data, both published and unpublished, that relates to the modern Mackenzie Delta. There is a bibliography and there is a map, and I thought that rather than simply indicate it's available, it might be marked as an exhibit and will be retained in the Inquiry Offices at Yellowknife for inspection by any interested participant or person.

(MACKENZIE DELTA SUMMARY REPORT OF SURFACE
CONDITIONS MARKED EXHIBIT 126)

THE COMMISSIONER: So ordered.

MR. MARSHALL: Sir, you'll

recall when we were last assembled that you asked Mr. Fielder for additional information as to the locations of certain of gas pipelines in the U.S.S.R., and he has over the

Fielder, Hurd, Carlson
In Chief

1 weekend prepared some materials, some maps, and he
2 has some remarks as well. He's had them typed up, sir,
3 and I can distribute copies if you'd like. If it meets
4 with your approval, I propose that he present that
5 material now before cross-examination of the panel
6 begins.

7 THE COMMISSIONER: Yes, cert-
8 ainly.

9
10 DONALD ERNEST FIELDER,
11 LEE GORDON HURD,
12 MELVIN E. CARLSON, resumed:

13 DIRECT EXAMINATION BY MR. MARSHALL (CONTINUED):

14 Q Mr. Fielder?

15 A You will recall, Mr.
16 Commissioner, that I stated last week that there are
17 three gas pipeline systems in the Soviet Arctic instal-
18 led in areas containing permafrost. These are the
19 Taas-Tumus Yakutsk-Pokrovsk Line in Eastern
20 Siberia, the system I referred to last week as the
21 Yakutsk line; secondly, there is the Messoyakha-Norilsk
22 Line; and thirdly, the system of which I saw part which
23 serves the Medverzhye Gas Field in Northwestern
24 Siberia and which is sometimes referred to as the
25 "Northern Lights" System. The presentation that was
26 just given to you includes some maps which will help
27 you locate those systems relative to better known
28 places in Russia; but I can project them on the screen
29 for the benefit of those who don't have that.

30 Sir, this map shows the U.S.S.R.
31 and shows the three systems that I referred to. Firstly,

Fielder, Hurd, Carlson
In Chief

1 excuse me for standing in front of it, firstly there
2 is the Yakutsk system shown up here, and it actually
3 runs from a place called Taas-Tumus through Yakutsk to
4 Pokrovsk. You'll have to forgive the spelling.
5 Every time one picks up a report, Russian names are
6 spelled differently from the last time. To help get
7 you oriented, the Port of Vladivostok is down here, so
8 that's in Eastern Siberia.

9 The second system, the one
10 that's entirely beyond north of the Arctic Circle
11 running from Messoyakha to Norilsk; and the system that
12 I saw part of which runs from this general area here
13 down through Nadym to Punga where it ties into
14 a system that was constructed prior to that time.

#1

#2

#2

15 This map shows the Soviet grid
16 system that I referred to last week. You see Medverzhye
17 here, and it runs down to what on this map appears to
18 be Igrim but in actual fact is Punga. I think it
19 must be a town very close by, but you'll see that
20 once they get here there is access to Moscow into the
21 south to the Ukraine, in the Caspian and Black Sea
22 areas as well as virtually all of Western Russia.
23 So far as I am aware, sir, this system is shown here
24 to the north with dashed lines to Medverzhye to
25 Ukhta has never been constructed.

26

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1 This map shows the Medverzhye
2 area just a little more clearly. This is the
3 Bay of the Ob River which runs up from this general
4 area into this Bay at this point, flows into the Arctic
#3 5 Ocean and the Medverzhye field here running off to Punga
6 where it ties into the system that we mentioned
7 before and you can also see schematically the
8 Messoyakha-Norilsk line on the same map.

↑
↓
9 A blown up of the Messoyakha-
10 Norilsk ^{gas} pipeline system, you can see that it crosses
#4 11 a number of rivers, as it runs from Messoyakha through
12 Fakel on to Norilsk.

↑
13 The Messoyakha-Norilsk system
14 as is the case for the Yakutsk system are local
15 in significance, that is, they are not tied to the
16 grid system.

↓
17 And once again, another
18 blow up of the Messoyakha -- excuse me, of the
19 Medverzhye system. You will note here also some
20 discrepancies from some of the comments I will make in
21 a few moments, it shows the length at 365 miles --
#5 22 or --67 miles, we were told 415 miles in length and
23 it shows that the first 145 miles will be constructed a-
24 bove ground and that is not the case. The whole system
25 was constructed either on ground level or else was
26 buried.

↑
27 That concludes the maps that
28 I have to show you, Mr. Commissioner, and I will
29 go back to the table now and tell you about those systems.

30 Since we met last I extracted

1 of
2 from the reports/which I had copies and which described
3 the visits of two separate groups to the Messoyakha-Nor-
4 ilsk system, and from another report that I had not
5 seen prior to this last weekend which was published by
6 the American Gas Association in 1970 and it is called,
7 "Gas in the Soviet Union", enough information to
8 prepare a brief description of those three systems that I
9 just showed you on the maps.

10 Firstly, the Yakutsk system.

11 "The construction of the Taas - Tumus -Yakutsk-
12 Pokrovsk gas pipeline, the first transmission gas
13 pipeline to be built in the Arctic was begun in
14 1964. The distance between Taas-Tumus and
15 Pokrovsk is 356 kilometers which is about 221 miles.
16 And 193 of those kilometers, or about 120 miles of that
17 length was laid above ground on supports. To
18 Yakutsk the line is 20 inches in diameter, beyond
19 Yakutsk to Pokrovsk the line is only ten inches. This
20 line is of only local significance in terms of
21 gas distribution but has been a useful testing
22 ground for construction techniques in the permafrost."
23 The last four sentences that I have just read are
24 quoted directly from the American Gas Association
25 report I described earlier, except for the conversions
26 for the metric units for which I am responsible.
27 I am sorry that I was not able to contact any of the
28 people who saw this system in 1973 to get any more inform-
29 ation.

30 The Messoyakha-Norilsk System.

To describe this system I have relied rather heavily on a

1 report prepared by Dr. R.S. Taylor, Ph.D., P. Eng.,
2 who visited Russia in 1973 as a member of the
3 Canadian Gas Working Group and who worked for Arctic
4 Gas at that time; and a report prepared by the Gas Working
5 Group who visited in 1972 as well as the AGA report
6 described earlier. The system was located in 1967,
7 the design started in 1968 and by mid-1970 gas reached
8 Norilsk. This information is extracted from the
9 1970 report which differs from the 1973 report which
10 says that the line was started in 1967 and completed in
11 1968. The comments that follow are taken directly from
12 Dr. Taylor's report:

13 "The first line was started in 1967 and completed
14 in 1968. The second (looped) line was built in the
15 winters of 1971 - 72 and 1972 - 73. Separation
16 between the lines varies from 500 m to 4 km. There are
17 at least four valved cross-over lines connecting
18 the mains. The mains are manifolded on both banks
19 of the Yenesei River, which is crossed under water
20 by six, 40 cm lines. Besides this crossing, there are
21 three major and 80 minor stream crossings. System
22 length (single line) is 265 km; straight-line dist -
23 ance to the field to Norilsk is 230 kilometers."

Fielder, Hurd, Carlson
In Chief

1 As I mentioned last week to you,
2 sir, that that was quite an extension from the direct
3 straight line length. I think I used 13% last week, and
4 the figure is actually 15%.

5 "The pipe diameter is 72
6 centimeters, wall thickness of 11 millimeters, of
7 German low carbon steel No. 09-GC-2 steel No. 10.
8 Operating pressure is 55 atmospheres, pressure drop
9 along the line is 5 to 7 atmospheres in summer; 10
10 to 12 atmospheres in winter. There are no compressor
11 stations between the field and Norilsk. Operating
12 temperature is ambient temperature, that is gas at
13 well-head enters the gathering system at minus 1, plus
14 2 degrees Celsius."

15 "With a few short exceptions,
16 the pipelines are all pile-mounted generally with
17 bottom of pipe one meter or more above the ground
18 surface. Piles are timber, reinforced concrete or
19 steel pipe. Rest bars between piles are steel. Some
20 of the exceptions are a few short test sections where
21 the pipeline is laid on recessed horizontal supports
22 with bottom of pipe at ground surface. The balance
23 of the exceptions relate to stream crossings. Expansion
24 is accommodated by V-sections about 20 meters by 200
25 meters, at irregular intervals that appear to be about
26 500 meters to 750 meters apart."

27 That concludes my quotes from
28 Dr. Taylor's report.

29 As I mentioned during my
30 presentation last week, I was able to confirm during

Fielder, Hurd, Carlson
In Chief

1 the Soviet^{visit} to Calgary on March 21, 1975, that the system
2 does indeed currently consist of two 28-inch lines.
3 That's 72 centimeters. This system is probably the
4 most northernmost gas pipeline in the world, being
5 laid in its entirety north of the Arctic Circle between
6 the 69th and 70th Parallel. You will note that Dr.
7 Taylor's Report goes into considerable detail in such
8 areas as design, construction and logistics.

9 The Medverzhye to Punga
10 system; in this instance I'll quote from my own report
11 which was, I believe, circulated last week. The
12 Medverzhye area contains gas reserves which are huge
13 by North American standards, having proven reserves
14 in the order of 14 trillion^{cubic} meters. The Medverzhye
15 field itself, 1.5 trillion cubic meters. For purposes
16 of comparison, the 27 trillion cubic feet commonly
17 stated as Prudhoe Bay-Alaska reserves amounts to less
18 than 0.8 trillion cubic meters. Medverzhye gas pro-
19 duction is estimated at an average of 24 million cubic
20 meters per day in 1973 and 60 to 65 million cubic meters
21 per day in 1974, which is about 2.3 billion cubic
22 ~~meters~~^{feet} per day, is transported through a 48-inch and
23 56-inch trunkline system to Punga, near the Ob River
24 where gas enters an established trunkline system
25 extending to the Central European area of the U.S.S.R.

26 The first line laid had a
27 diameter of 1,220 millimeters, or 48-inch. The loops
28 which have been and are being constructed will be 1420
29 millimeter, or 56-inch. Including loops, the system
30 consisted of about 1,500 km. of pipeline or about 930

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1 miles at the end of 1974. The distance from Medverzhye
2 to Punga, 670 km. or 415 miles.

3 ~~Large~~ river crossings are
4 buried in the river bed and are dualled or twinned. When
5 the main crossing is 1,420 millimeter (56-inch), the
6 spare crossing is normally 1,020 millimeter or
7 42-inch.

8 The pipeline configuration is
9 either buried or bermed. When buried the cover is
10 normally 0.8 meters, or about 30 inches. When crossing
11 marshes both buried and bermed configurations are used
12 but the line is mostly buried because the water is
13 usually only about 2 meters deep.

14 In permafrost areas roads are
15 constructed by building up a gravel grade over tree
16 limbs.

17 You'll recall, sir, that I
18 described last week the terrain we overflow. I explain-
19 ed that the area had not been glaciated and that perma-
20 frost problems were minimal. To quote my report:

21 "What we saw was an area in which conventional
22 winter pipeline construction techniques would be
23 utilized in Canada, as it is very similar to
24 Northern Alberta."

25 Five compressor stations will
26 probably be constructed with spacing of 130 km., or
27 about 80 miles. This rather large spacing is considered
28 economical there. I visited one of these stations,
29 I believe the only one built to date, called Long-
30 Yuganskaya. It included six 6,000 kilowatt units

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1 (about 8,000 horsepower), each of which is able to move
2 18 million cubic meters per day. The station is not
3 remotely controlled and is normally operated on a
4 local automatic mode, although local manual is also
5 possible. A station suction pressure of 55 atmospheres
6 -- that's 810 p.s.i. approximately -- and a discharge
7 pressure of 75 atmospheres -- about 1,100 p.s.i. --
8 are normal. Gas reaches this station using reservoir
9 pressure (about 100 atmospheres) from the Medverzhye
10 field. Suction temperature is about plus three degrees
11 Centigrade, and discharge temperature about 40 degrees
12 Celsius, which is the range of 37 to 104 degrees
13 Fahrenheit.

14 Sir, I've attempted to
15 excerpt the information you requested from the reports
16 I have available to me and hope that I have presented
17 the information you requested and that you find it
18 useful.

19 Before I conclude, I'd like
20 to make certain that I did not leave an impression
21 last week that could be misinterpreted. I stated
22 then -- and I quote:

23 "We will probably not learn a great deal more
24 from additional visits to Russia,"
25 and that, referring to reports prepared by others,
26 "perusal of their reports did not add a great
27 deal to our knowledge of permafrost pipeline
28 techniques."

29 IN a "nuts and bolts" sense, I believe what I said to
30 be true. However, there is one very important thing

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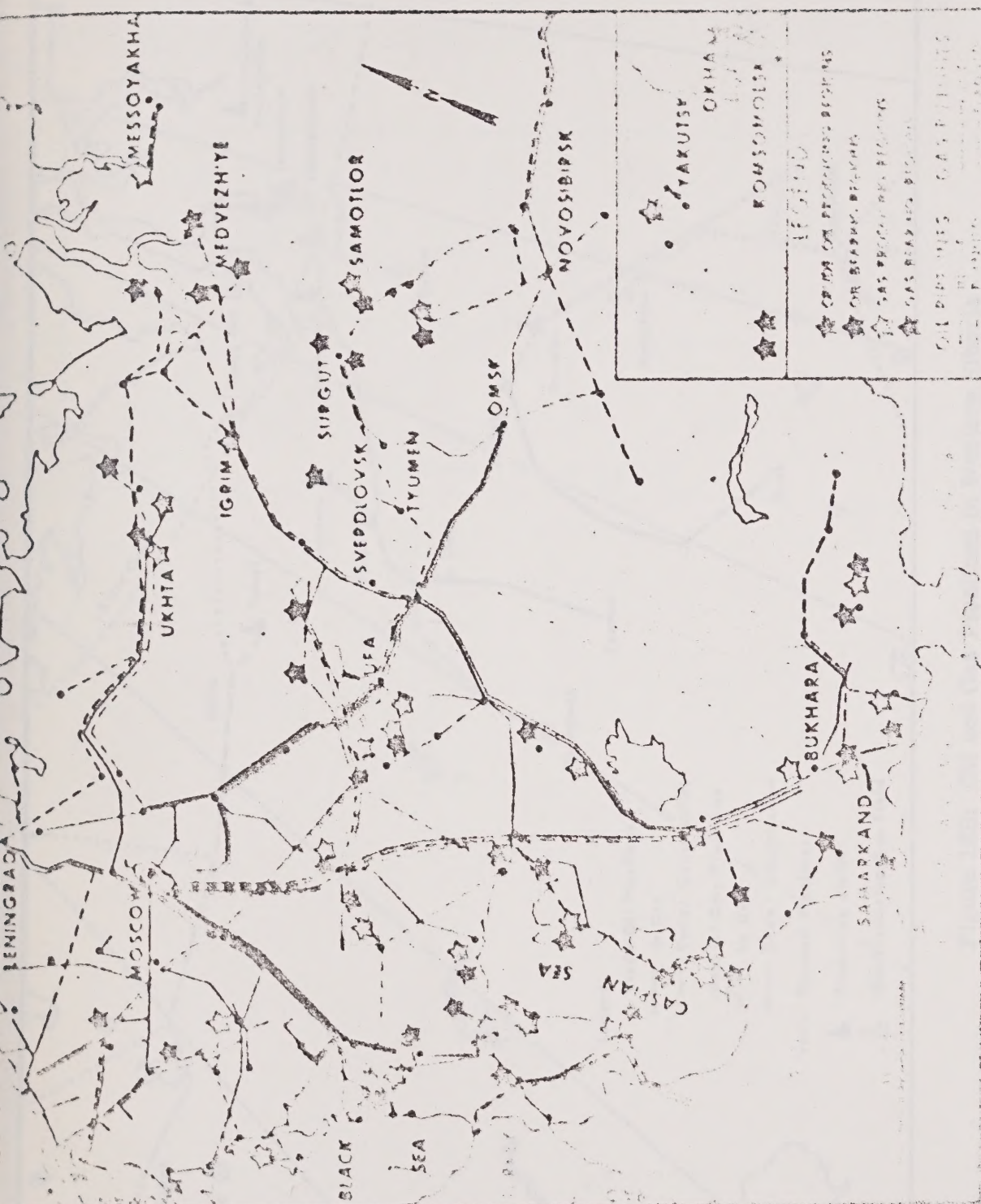
1 we learned from what the Soviets have done and I think
2 it's worth mentioning at this point. It is this --
3 they got the job done. That is facing Arctic tempera-
4 tures, winter darkness and the extreme logistical
5 problems associated with both the climate and the
6 geography, they did design and are still designing, up
7 to eight lines from Medverzhye ; they did construct
8 and are still constructing; and they are operating at
9 this moment; hundreds of miles of gas production, treat-
10 ment, and pipeline facilities in their Arctic. I
11 consider this accomplishment to be most commendable.

12 THE COMMISSIONER: Thank you
13 very much, Mr. Fielder. I appreciate your taking the
14 trouble to put those maps together and explaining
15 them as clearly as you have.

16 A You're most welcome,
17 sir.

18 ~~MR. HOLLINGWORTH. Mr.~~
19 ~~Commissioner, last week on Thursday, I believe it was,~~
20 ~~you made an enquiry about what research El Paso had~~
21 ~~done into the frost bulb technique, and my solution~~
22 ~~was going to be to have a Foodhills representative in~~
23 ~~Washington check the El Paso application, but that~~
24 ~~deed was obviated when I spoke to Dr. Harlan, who~~
25 ~~briefly appeared on the last panel, who advised me~~
26 ~~that El Paso has decided that frost bulbs won't be~~
27 ~~a problem, since~~
28 ~~at river crossings their pipe is going to~~
29 ~~be coated with six inches of concrete which will~~
30 ~~provide effective insulation and there won't be a frost~~
~~bulb problem. Now, that's their apparent solution.~~

#2



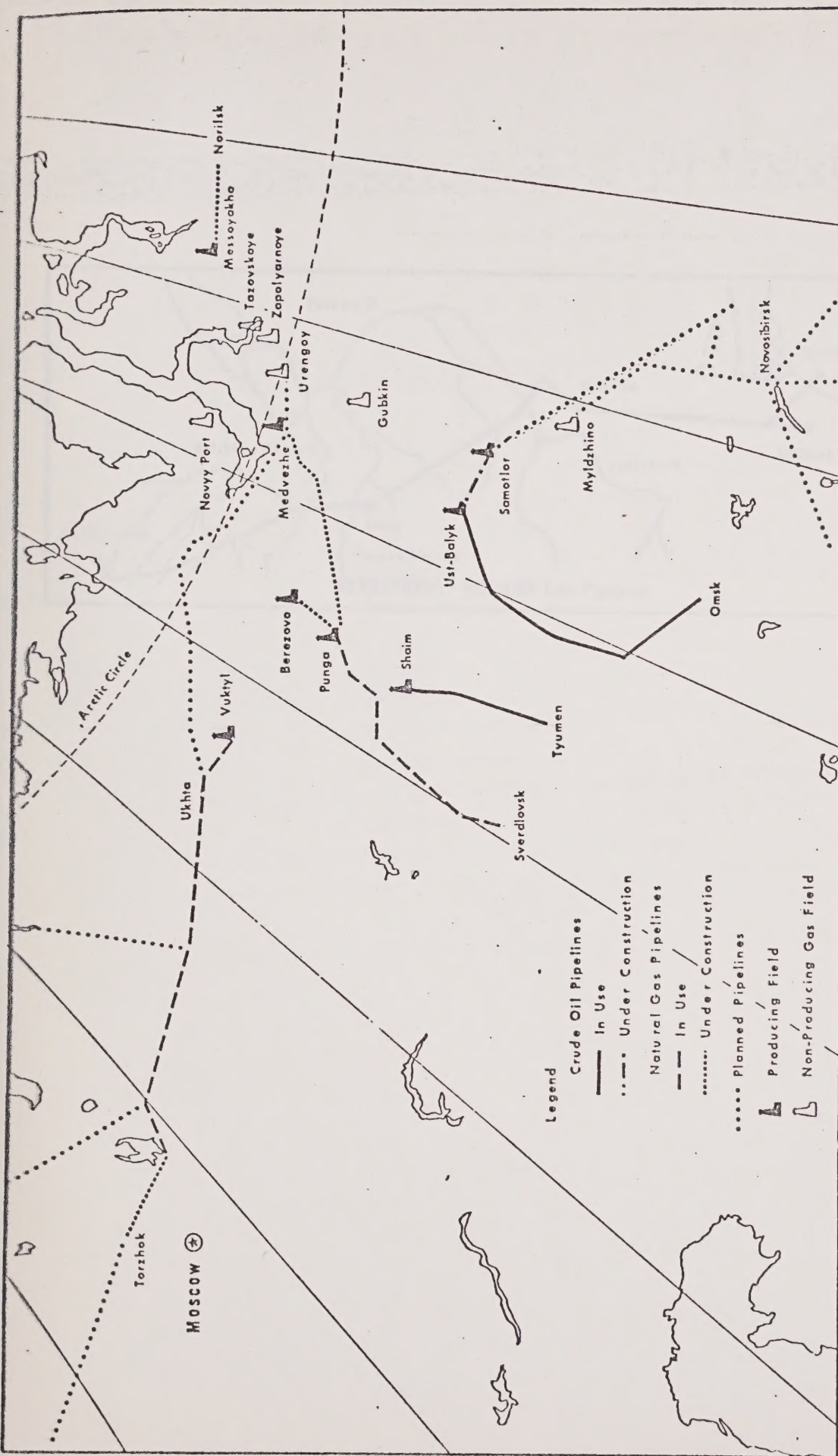
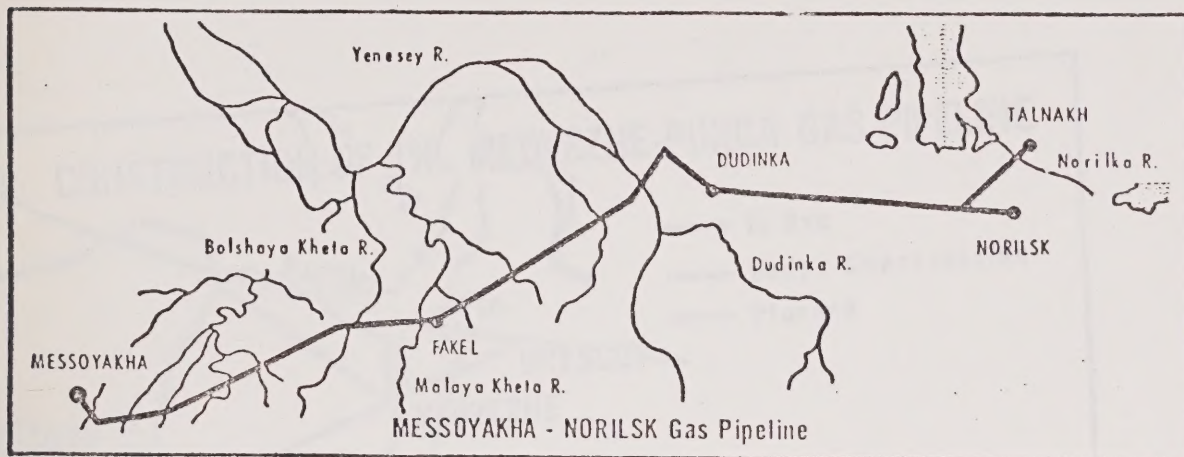


Figure 18B: Oil and Gas Pipelines in Western Siberia

#4
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#5

